cremated remains were found in the vicinity of the pyral mounds. The skeletons, as a rule, were so frail that comparatively few could be preserved. Of the whole number about one hundred good skulls, and probably fifty tolerably complete skeletons, were collected. These were so frail that Dr. Wortman was compelled to use a goodly supply of shellac varnish to keep them from falling to dust. Silicate of soda was tried, but it was not found so good as the ordinary shellac dissolved in alcohol.

The objects which go to make up the collection are various, and consist of those of ornament and utility. Numerous shell carvings, some of which had been beautifully inlaid with turquoise, were found, while a very few copper ornaments in the shape of bells and ear-rings were also dug up. Their tools consist almost entirely of stone, and were, for the most part, polished, though such implements as potters' stones, rasps, mauls, metates, &c., were never polished. Their stone axes and hatchets are of the ordinary pattern, and are generally well polished; they are of various sizes and shapes, and some of them were no doubt used as picks in digging up the hard cement and gravel in the construction of their irrigating canals. Stone hoes, knives, and arrow-heads were also found in abundance.

The collection of pottery is large, and, according to Mr. Cushing, resembles that of Zuñi manufacture more than any other people. It is often highly decorated with quaint and unique patterns, in various colours, and some fragments exhibited a fine glaze, which indicates a high state of the ceramic art.

That they were acquainted with metals there can be but little doubt, although they do not appear to have made use of it except in the way of ornament. Some places in the neighbouring mountains seemed to indicate that they mined for ore, which they smelted in crude ovens. Whether this was copper or the precious metals is now difficult to determine, but that they were accustomed to bring these ovens or furnaces to a very high heat is indicated by the slag in their immediate vicinity.

It is perhaps premature to attempt to decide who these people were, to whom they were related, and what became of them. I think it fairly settled by these discoveries that they were the ancestors of the modern Pueblos. Whether or not they were in any way connected with the ancient people of Mexico and Yucatan the future alone can decide. It seems certain, however, that one part of them went north to found the later Pueblo civilizations which are now represented by the Zuñis of to-day.

If historical evidence is worth anything, and if we can trust the ordinary evidences of archæology, then these ruins are beyond question pre-Columbian, and may be as much as a thousand years old.

Mr. Cushing's final Report will be awaited with interest by all who are in any way interested in the subject. The archæological specimens have been shipped to Salem, and the skeletons will go to the Army Medical Museum in Washington.

SELF-REPRODUCING FOOD FOR YOUNG FISH.

IN a very interesting Report of the United States Consul at Marseilles on the above subject, he says that every person interested in the artificial propagation of fish, particularly those of the genus *Salmonidæ*, knows the great care which is necessary to carry the young fry through the period immediately following the absorption of the umbilical sac, and to bring them to such a stage of maturity that they can be safely turned loose in open ponds and streams to shift for themselves. The mere hatching of the eggs presents no difficulty, but with the commencement of artificial nutrition the serious part of the work begins, and it is usually only a small percentage of the swarms which are hatched that reach the maturity of yearlings. During the intervening months it has been customary to feed the young fish on curdled milk, coagulated blood, finely hashed meat and liver, grated yolk of eggs, macerated brains of animals, &c., the preparation of which, and the constant feeding of the little creatures, involves constant and costly labour. Besides, none of these forms of nutriment have been found entirely satisfactory; they are artificial, and different from the living organic food which Nature provides. A plan invented by Mr. F. Lugrin, of Geneva, and practised since 1884 with the greatest success in the piscicultural establishment at Gremaz, in the province of Ain, in Eastern France, seems to overcome all these difficulties. The apparatus at Gremaz occupies a gently-sloping piece of ground, about six acres in extent, watered by three springs, which collectively yield about 500 gallons of water a minute. The tanks are about 120 feet long, 12 feet wide, and 5 feet deep. On account of the gravelly nature of the soil, the walls and bottoms of some of the tanks are lined with cement. The tanks are divided by sliding gates of wire gauze sufficiently fine to prevent the passage of the fry. Mr. Lugrin spreads upon the bottom of these tanks a material impregnated with the elements necessary to produce spontaneously a limitless number of *Daphniæ*, *Cyclops*, *Limnæ*, as well as larvæ of various *Ephemeræ* which form the natural aliment of trout and other *Salmonidæ*. This producing material is of trifling cost. The water in the tanks, which is from 2 to 3 feet deep, is left undisturbed for a few weeks, and is then found to be peopled with myriads of the species above named. With a fairly abundant propagation of these organisms, 20,000 young fry and 3000 fish one year old can subsist and thrive for a whole month in a tank of the size of one of those at Gremaz. These 23,000 fish and fry will eat from 600 to 800 pounds in a month, and each tank at Gremaz will produce from 650 to 900 pounds of *crevettes* (freshwater shrimps), to say nothing of the myriads of other species which are produced at the same time. Trout raised by this method have the flavour and firmness of wild fish. One great advantage of Mr. Lugrin's system is, that once a tank is prepared it is permanently productive.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The lecture-lists for this term contain no considerable innovations in the physical and chemical teaching. The usual systematic courses are to be given at the University Museum, and at Balliol, Christ Church, and Trinity. We may notice especially the following lectures:—

Prof. Pritchard, Recent Speculations on the Structure of the Stellar Universe, Spherical Astronomy, and the Theory of Errors; Prof. Price, Optics; Mr. Walker, Double Refraction treated Mathematically; Mr. Baynes, Theory of Gases, and Practical Electrical Measurements; Prof. Odling, 5-Carbon and 6-Carbon Compounds; Mr. Vernon Harcourt, Volumetric Analysis.

In the Biological Departments two new Professors have just entered on their offices. Prof. Green is giving two courses of lectures on Geology, and improving the Museum collections, and Prof. Vines has begun a systematic course of Elementary Botany. The Morphological Laboratory is in charge of Dr. Hickson and Mr. Latter; and Mr. Mitchell lectures on the Geographical Distribution of Animals. Prof. Burdon-Sanderson is lecturing on Elementary Physiology, and Mr. Gotch has a more advanced course. Dr. Tylor's subject this term is Race, Language, and Civilization.

An important statute has just past Convocation, which introduces the biological sciences into the Pass Examinations of the University for the B.A. degree. It is expected that the change will be of great use, especially to medical students, who cannot afford the time required to read for an Honour Examination in Natural Science.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 15.—M. Des Cloizeaux in the chair.—On the deformation of the images of stars seen by reflection on the surface of the sea, by M. C. Wolf. An attempt is here made to calculate the extent of this deformation, attention to which has lately been drawn by M. Riccò. The calculation shows that the difference in the angular heights of the object and its image increases towards the zenith, at first rapidly, then slowly, attaining its maximum at the zenith, for which it is double the depression of the horizon. A luminous band stretching from the apparent horizon to the zenith of the observer, and subtending an angle of 90° 19′·2, would give an image terminating at the nadir, and with an angular extent of not more than 90° – 19′·2.—On the latent colours of bodies, by M. G. Govi. The experiments here described with the bi-iodide of mercury, minium, and some other substances exposed to the light of the incandescent vapour of sodium—that is, the nearly pure yellow light D—tend to show that ordinary diffused or transmitted light does not give us the true colour of bodies. To obtain this true, but *invisible* or *latent* colour, a special process of illumination is

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needed. In general, solar or diffused light, not containing all the visible coloured radiations, is incapable always of showing us the true colour of bodies; further, the light given by incandescent bodies containing all the visible radiations is insufficient to disclose this true colour, which can be discovered only by means of a complete continuous spectrum without absorption bands or rays, or by simple radiations from incandescent gases. In such lights the true colour is that which is diffused or transmitted with greatest intensity, or else the blend of those so diffused or transmitted. This is somewhat analogous to the dichroism or polychroism of certain substances, as, for instance, the alcoholic solution of chlorophyll, which may seem green, brown, or red, according to its degree of concentration or its thickness on the path of the white light traversing it.—On the observations of stars by reflection, and on the measurement of the flexion of Gambey's circle, by M. Périgaud. The experiments here described with the modified form of Villarceau's mercury bath, lately submitted to the Academy, have enabled the author, as he anticipated, to obtain good images of reflected stars. Thus have been easily obtained within a period of five or six weeks about three direct and six reflected observations of about a hundred stars of all altitudes from 25° above the southern to 25° above the northern horizon. A calculation of the flexion of Gambey's circle yields a value practically identical with that given by Villarceau.—On the luminous ligament in the transits and occultations of Jupiter's satellites, by M. Ch. André. In a recent communication (*Comptes rendus*, cvii. p. 216) the author showed that one of the chief causes of uncertainty in these observations was due to the formation in the focal plane of the telescope, and, within a certain distance of the geometrical contact, to a luminous connection or "ligament" between the images of the satellite and the planet. A method is here explained by means of which the possible errors due to this phenomenon may be avoided.—Observations of Brewster's neutral point, by MM. J. L. Soret and Ch. Soret. The neutral point of atmospheric polarization situated below the sun has rarely been observed since its existence was first determined by Brewster. The authors have now been able accurately to observe it on the summit of Rigi (1800 mètres) on the mornings of September 23 and 24, the height of the sun above the horizon being from 20° to 35°. They were able at the same time to determine the distance of the neutral point above the sun (Babinet's neutral point).—On some double phosphates of yttria and of potassa or soda, by M. A. Dubois. These phosphates have been obtained by causing the amorphous phosphate of yttria to react, by the dry process, on the sulphate of potassa (H. Debray's process, extended by Grandeau to the chief groups of metallic oxides); and also by making the pure yttria react at a high temperature on the metaphosphates and pyrophosphates of potassa and soda.—On the alkaloids of cod liver oil (continued), by MM. Arm. Gautier and L. Morgues. Having already determined the volatile alkaloids, butylamine, amylamine, hexylamine, and hydrodimethylpyridine, the authors here describe the two fixed bases accompanying them. These are named *aselline*, from *Asellus major*, the large cod; and *morrhuine*, from *Gadus morrhua*, the common cod; the latter being especially remarkable for its physiological properties. The respective formulas are, $C_{25}H_{32}N_4$ and $C_{19}H_{27}N_3$.—On propylphycite, by M. Ad. Fauconnier. Under this name, Carius described, in 1865, a body with the formula $C_3H_8O_4$, which Claus afterwards declared to be the glyceric aldehyde, unknown in a pure state. From the author's further researches it now appears that propylphycite is nothing but glycerine itself.

STOCKHOLM.

Royal Academy of Sciences, October 10.—Species Sargassorum Australiæ descriptæ et dispositæ a Prof. T. G. Agardh.—On persulphocyanacid and dithiocyanacid, by Dr. Klason.—On a scientific tour in Russia, Germany, and Holland, by Dr. S. Arrhenius.—On a magnetic field balance, by Dr. Ångström.—Baron Nordenskiöld exhibited an edition, from 1560, of Mercator's large map of the world, lately discovered by himself.—On a new arseniate mineral from Mossgrufvan, in Nordmark, by Hr. Sjögren.—On the anatomical structure of *Desmarestia aculeata*, Lam., by Miss E. Söderström.—On a class of transcendents, which originate through iterated integration of rational functions, by M. A. Jonquière, of Bern.—On aceto-propyl-benzol and aceto-kumol and their derivatives, by Prof. Widman.—The electrical and thermic conductibility of specular iron, by Hr. H. Bäckström.—Contributions to the knowledge of the thermo-electricity of crystals, by the same.—Determination of the magnetic inclination in Stockholm, Sundsvall, and Östersund, by Hr. P. A. Siljeström.

AMSTERDAM.

Royal Academy of Sciences, September 29.—M. de Vries read a paper on sterile plants of maize or Indian corn.—M. Van Bemmelen discussed the contents of a paper of M. Bakhuis Rozeboom, on the combinations of calcium chloride with water in solid and fluid condition.—M. J. A. C. Oudemans read a paper on levels becoming unfit for use by the diminished mobility of the bubble, in consequence of the precipitation of granular corpuscles against the interior surface of the glass. He demonstrated that this evil could be obviated by (1) constructing the levels of kali-glass, and not of natron-glass; (2) taking care that no water should be able to penetrate into the interior of the instrument; and (3) employing, instead of sulphuric ether, petroleum ether for the filling.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

The Fatal Illness of Frederick the Noble: Sir M. Mackenzie (Sampson Low).—The Senses, Instincts, and Intelligence of Animals: Sir John Lubbock (Kegan Paul).—Lectures on the Ikosahedron and the Solution of Equations of the Fifth Degree: F. Klein, translated by G. G. Morrice (Trübner).—Text-book of Practical Logarithms and Trigonometry: J. H. Palmer (Macmillan).—Experimental Mechanics, 2nd edition: Sir R. S. Ball (Macmillan).—Examples for Practice in the use of Seven-figure Logarithms: J. Wolstenholme (Macmillan).—The History of Australian Exploration, 1788–1888: E. Favenc (Turner and Henderson, Sydney).—A Manual of the Vertebrate Animals of the Northern United States, 5th edition: D. S. Jordan (McClurg, Chicago).—Outlines of Natural Philosophy, enlarged edition: J. D. Everett (Blackie).—The British Moss Flora, Part xi.: R. Braithwaite (published by author).—The Theory and Practice of Absolute Measurements in Electricity and Magnetism, vol. i.: A. Gray (Macmillan).—Mathematical Examples: J. M. Dyer and P. Prowde-Smith (Bell).—The Student's Pestalozzi: J. Russell (Sonnenschein).—Journal of the Royal Microscopical Society, October (Williams and Norgate).—Journal of the Royal Statistical Society, September (Stanford).—Annalen der Physik und Chemie, 1888, No. 10; Beiblätter zu den Annalen der Physik und Chemie, 1888, No. 9 (Barth, Leipzig).—Bulletin of the American Geographical Society, vol. xx. No. 3 (New York).—Bulletins de la Société d'Anthropologie de Paris, Tome xi. (3 Série) Fasc. 1 and 2 (Masson, Paris).

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